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Meeting goals of sustainability policy: CO_2 emission reduction, cost-effectiveness and societal acceptance. An analysis of the proposal to phase-out coal in the Netherlands

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ABSTRACT

The mitigation of global climate change renders effective policy indispensable. In this paper we evaluate a policy drafted in the Netherlands to close all its remaining coal-fired plants by 2030, which is well before the end of their technical and economic life spans. This plan is part of a package to reduce CO_2 emissions with 25% by 2020 and 49% by 2030 in comparison to 1990. Under Dutch policy, all measures taken must meet three goals: CO_2 emission reduction, cost-effectiveness and societal support. We will show that existing EU legal frameworks limit the effectiveness of the closure, because they allow for carbon leakage and lack a coordinated European strategy on the coal phase out, even though several EU member states have formulated similar plans. There is also no definitive answer as to whether the coal phase out is cost-effective. Dutch government will have to decide what the parameters of 'cost-effective' are. So far, the plan enjoys societal support. It is up to the Dutch government to decide what balance between CO_2 emissions, costs and societal support is best. For further action, we recommend an EU strategy on the coal-phase out, in order to coordinate and to prevent carbon leakages.

1. Introduction

Upon signing the Paris Agreement of December 2015 195 countries agreed to make an effort to limit global temperature rise to 2 °C, though preferably to 1.5°. In order to meet this goal, the European Union (EU) and EU member states have set a CO_2 emission reduction target of at least 40% to be realised by 2030 in comparison to 1990 (COM/2014/015). This target may be increased to 50 or 55% by 2030 in comparison to 1990, given the most recent debates in the European Parliament, also with respect to the election of the new president and commissioner for climate and energy.

Energy production plays a large role in CO_2 emissions, causing an average of 40% of all CO_2 emissions in the OECD countries in 2015 (EIA, 2016). Of the three most important fossil fuels – gas, oil and coal – the latter two produce most CO_2 emissions. In the OECD countries, oil and coal combustion together are responsible for 73% of all energy related CO_2 emissions, a total of 2.2 Gton CO_2 emissions in 2015 (EIA, 2016). With these statistics, the energy industry has become one of the most important pillars of sustainability policy, both in individual states and in transnational policy. An example of such transnational policy concerns the 20-20-20% targets of the EU which aim at energy efficiency; on the basis of a prognoses made in 2007 of primary energy consumption for 2020, the EU set a target to increase energy efficiency by 20% by 2020, leading to reduction of 1.474 Mtoe by 2020 (2012/27/EU), a share of

Abbreviations: CFPP, Coal-fired power plant; ETS, European Emission Trade System; EU, European Union; Mton, Megaton; RES, Renewable energy sources; SCC, Social costs of carbon.

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20% consumption of renewable energy by 2020 (2009/28/EC), which has been translated into member state specific targets, and a reduction of 20% of greenhouse gasses in comparison to 1990, all to be realised by 2020 (2009/29/EC).

Since the deadline – the end of 2020 – is approaching rapidly, the EU has proposed a new set of targets, to be met by 2030: an increase of energy-efficiency of 32.5% based on the prognoses made in 2007, equalling to another reduction of 1.273 Mtoe in the primary energy consumption (EU 2018/2002), an increase in the share of RES up to 32% (EU 2018/2001) and a CO_2 reduction target of at least 40% in comparison to 1990 (COM/2014/015). With such an ambitious target for 2030 sustainable action must be effective: the proposed measures must be sufficient to achieve the policy objectives.

1.1. Energy transition in Dutch context: progress and proposed policy for 2030

As the EU targets are binding, EU member states have to ensure their realization. Based on this obligation and the voluntary commitment to the Paris Agreement, member states have formulated national sustainability policies. The Netherlands, whose EU share of renewable energy sources (RES) target is 14% by 2020 (2009/28/EC), is no exception. To date however, the Netherlands lags behind on the realization of these targets, with a share of RES of 6.6% in 2017 (Eurostat, 2017) and 14.5% reduction of greenhouse gasses in 2018 in comparison to 1990 (CBS, 2019). Current Dutch sustainability policy aims at a low carbon economy (EZ, 2016a and b) and since the Dutch energy industry is responsible for 80% of all CO_2 emissions in the Netherlands (EZ, 2016a), much is expected from the Dutch transition to a low carbon energy system.

In order to accelerate this transition, the newly installed government formulated an ambitious sustainability policy (Coalition Agreement, 2017). With a national CO_2 emission reduction target of 49% by 2030 in comparison to 1990, this government claims to be 'the greenest ever'. To this end, a Climate Act entered into force on 1 September 2019, containing targets for CO_2 emissions reduction; 49% by 2030 and 80 to 95% by 2050 in comparison to 1990, and complete CO_2 neutral production of electricity by 2050 (Climate Act, 2018; Backes, 2018). Simultaneously, a Climate Agreement has been negotiated, a public-private effort in which the 49% reduction target is translated into CO_2 Megaton (Mton) and divided amongst five sectors: energy intensive industry (14 Mton), transport (3.5 Mton), built environment (7 Mton), electricity production (20 Mton) and agriculture (3.5 Mton) (Coalition Agreement, 2017). In the Climate Agreement, industrial, environmental and societal agents decide with the government on necessary measures to achieve the reduction with a strong emphasis on societal support for the specific measures (Climate Agreement, 2019).

At the same time, pressure to achieve the 20-20-20 targets for the Netherlands is rising. The EU Commissioner for Climate Action and Energy has visited the Dutch minister of Economic Affairs and Climate Policy in April 2019, expressing that the Netherlands is lagging behind on meeting the three EU binding targets. Moreover, in 2015 and in 2018 in appeal, the Dutch state was sentenced by the Dutch court to realize CO_2 emission reduction of 25% by 2020 in comparison to 1990 (Urgenda I, 2015 and Urgenda II, 2018, the judgement of the Supreme Court is expected in December 2019). The Dutch court found that on the basis of scientific evidence, a higher CO_2 emission reduction – compared to the EU target of 20% by 2020 in comparison to 1990 – is necessary in order to limit the rise of global temperature. In January 2019, it was estimated on the basis of current policies that the Netherlands would only reduce its CO_2 emissions by 21% by 2020. These two development pressured the Netherlands to focus not only on new policies for 2030, but also to propose new measures to close the existing gap, especially given the Urgenda judgement, which includes the plan to accelerate the phasing out of the five remaining coal-fired power plants (CFPP), latest by 2030 (EZK, 2019b). Two of the five remaining plants became operational in 1994. The other three plants became operational in 2015 and 2016. These latter three plants adhere to the standards of the best-available techniques (2010/75/EU and BAT reference document) and have a technical life expectancy of at least 40 years.

1.2. A European coal-phase out and lessons learned

The Netherlands is not the only country aiming for a coal-phase out. Finland, Germany, the UK and Austria have formulated similar goals (Lund, 2017), whilst Poland plans for a substantial increase in coal power capacity (Shearer et al., 2016). In 2013, coal combustion was responsible for one third of total fossil-fuel-related CO_2 emissions in the European Union. Although, in 2015 a minor decrease of 1.8% occurred in coal consumption, therefore also decreasing the contribution of coal-combustion to fossil-fuel-related CO_2 emissions. However, considering that the share of coal in EU primary energy consumption still constituted 15.5% in 2016, a coal phase-out is a sensible step to meet climate targets (EEA, 2018).

Previous literature analyses coal phase-out plans for Finland (Lund, 2017) and Germany (Heinrichs and Markewitz, 2017), but also from a comparative perspective between the UK, Germany, Spain and Poland (Rentier et al., 2019). From this literature lessons can be drawn for future coal phase-out plans. Germany for instance, has a total installed capacity of 47 GW CFPP, totalling 24% of all installed capacity. In the study by Heinrichs and Markewitz (2017), the business as usual, with the CFPP to remain open until the end of their technical life expectancy is compared to a coal phase-out by 2039. After analysis they found that neither short nor long term goals would be achieved by a coal-phase alone. From their system analysis they moreover found that a coal-phase out would not be the most cost-efficient method due to a strain put on the energy system that is exacerbated by the nuclear phase-out in Germany.

In contrast, the analysis of the Finnish situation focuses on the alternative to be in place after a coal phase-out; a large-scale change to nuclear and biomass. The analysis by Lund (2017) shows sensitivities due to the two-option alternative, especially in case forestry biomass would not be considered CO_2 neutral in the future. Lund describes how the political decisions towards biomass and nuclear do not contain a contingency plan, in case such risks arise.

The study by Rentier et al. (2019) on the other hand show that the UK had access to rather cheap coal, especially in comparison to oil and gas. However, the introduction of the carbon price floor in 2013, adding costs on top of the EU emission trading system (EU ETS), aligned coal and gas prices, rendering the use of coal less attractive. The use of coal became even less attractive in 2015, when the carbon price floor doubled, leading to a stark decline in coal-based energy production.

The studies are, however, not consistent in drawing lessons on the contribution of a coal-phase out on CO_2 emission reductions, nor with respect to the potential costs or cost-effectiveness of the measures. Because of differences between EU member states with respect to their energy mixes, presence of coal-mines, financial instruments and alternative solutions a conclusive comparison is impossible. Yet, especially the example of the UK shows that an instrument with a relatively large impact on the use of coal is possible.

1.3. Aim of this article, research questions and methodology

The Dutch plan for a coal phase-out has been questioned with respect to two elements: 1) actual CO_2 emission reduction and 2) cost-effectiveness of the measure. Reports have been published on CO_2 emission (CE Delft, 2019) and cost-effectiveness (ECN, 2015a; SEO, 2016), but they do not paint a conclusive picture. This article provides a first, comprehensive analysis of these reports, aimed at answering whether a coal-phase out would be effective with respect to both CO_2 emission reduction and costs. We furthermore add a third factor to this analysis, namely societal acceptance of the coal phase-out. Since 2017, the Dutch government aims at cost-effective, low-carbon measures that

enjoy societal acceptance. This is also illustrated by the agreements closed under the Climate Agreement (2019), which focus on increasing societal acceptance of the Dutch energy transition by means of public participation and a (re)distribution of profits and burdens. It is therefore important that both specific measures, in this case the coal phase-out, and the overall energy transition policy receive societal acceptance.

This article addresses three key questions: 1) what is the policy and what are policy instruments regarding the phasing out of coal-combustion in the Netherlands? 2) Does this policy meet the goals of CO_2 emission reduction, cost-effectiveness, and societal acceptance? Answering these questions is relevant not only for the Dutch policy maker. Given the similar plans in Finland and Germany but also the high share of coal-combustion in countries such as Poland, lessons learned from the Netherlands may be used in other EU member states as well. Increasingly, energy sources are on the political agenda of the EU, especially with respect to fairness for countries depending on coal-combustion and therefore the relatively high impact energy transitions will have on these countries. The EU may be interested in how a transnational coal policy, taking into account for instance carbon leakage amongst EU member states and fairness, could be informed by the policies of early adaptors of coal-phase outs.

In order to answer our research questions, we use a framework for policy analysis. There are several methodological frameworks to analyse policy effectiveness, such as Sadler's (1996), Baker and McLelland's (2003) and Matland (1995). These three frameworks focus on policies that have been implemented and therefore its performance can be measured. However, in our case, the policies are in the development stage and, therefore, we chose to apply the framework of policy mixes for sustainability transitions (Rogge and Reichardt, 2016) to analyse how the policy intention to close the CFPP emerged. This framework consists of an analysis of policy on the basis of three buildings blocks: 1) policy strategy and goals, 2) policy processes, and 3) characteristics of this strategy and instruments. The first two steps are descriptive. The first step shows what strategy is followed, what objectives it serves and which plans are devised, and what instruments are proposed to meet the objectives and plans. The second step follows how these policies came about and assesses how the process has taken place. The third and last step of the framework of policy mixes for sustainability transitions concerns an analysis of the policy instruments on elements of consistency, coherence, credibility and comprehensiveness. Lastly, we analyse how the policy affects the three goals: 1) CO_2 emission reduction with 2) cost-effectiveness measures which 3) enjoy societal acceptance. An important part of this process concerns the societal debate on CFPP and how this has affected the political debate and ultimately, political decision-making. To this end, we apply the advocacy coalition framework for studying the policy processes as this framework allows us to identify and classify the formation of coalitions, their interests and the way these coalitions have affected the policy processes (Sabatier, 1988; Sabatier and Jenkins-Smith, 1993; Sabatier and Weible, 2007). This analysis is based on a desk-study of literature, policy documents and newspaper articles between the period of 2013 and 2018.

The structure of this article is as follows. In section 2 we address further into detail the three pillars of EU policy and Dutch progress on these targets. In section 3 we apply the three steps of the framework of policy mixes for sustainability transitions on the policy process towards phasing out coal in the Netherlands, in section 4 we summarize the article and analyse policy implications for the Netherlands, other EU member states and the EU.

2. The three pillars of EU energy goals and Dutch progress

2.1. Energy efficiency

According to article 2 of the EU Directive 2012/27/EU on energy efficiency, member states need to improve the efficiency by 20%. Energy efficiency is defined as "the ratio of output of performance, service, goods or energy, to input of energy. Therefore, energy efficiency improvement is defined as "an increase in energy efficiency as a result of technological, behavioral and/or economic changes". The energy efficiency target of 20% translates for the Netherlands to an improvement of 482 Petajoule by 2020 (ECN, 2015b). In 2016, an estimation of the potential energy savings due to energy efficiency improvements was made on the basis of current policy. This showed that by 2020 the Netherlands could achieve energy savings of 520 Petajoule, therefore amply meeting the target. More recent numbers however are not available.

2.2. Dutch energy mix and the share of RES

The Dutch energy industry is largely dependent on fossil fuels, with a total share of 92% in 2017. With a share of 6.6% renewable energy in 2017, biomass was responsible for 60% of this share. Table 1 below presents more detailed information on the Dutch energy mix.

The National Energy Report of 2017 predicts that the share of RES will increase to 12.2% by 2020 on the basis of current policy (PBL, 2019) and to 16.7% by 2023 (ECN, 2017). The target will be realised, but with a substantial delay.

2.3. Energy related CO_2 emissions and reductions

In 2018 CO_2 emissions were reduced by 14.5% in comparison to 1990 (CBS, 2019). This concerns a further 2% reduction in comparison to 2017. At the same time, in January 2019 it became clear that by late 2020, the reduction will be 21% in comparison to 1990, thus falling short of meeting the Urgenda target (EZK, 2019a).

It is important to make a distinction between EU ETS and non-EU ETS CO_2 emissions. The ETS is a system of emission rights that need to be purchased by companies in order to be able to produce CO_2 emissions. About 45% of all European emissions are encompassed by the ETS system. All electricity plants fall under the EU ETS (2009/29/EC). The remaining 55% CO_2 emissions are not subject to the ETS system but companies are still under the obligation to reduce the non-ETS emissions by 20%.

CO_2 emissions in the Netherlands are volatile. Between 2009 and 2012 4% CO_2 emissions were reduced in comparison to 1990. However, between 2013 and 2016 there was an increased electricity production with coal in the Netherlands, increasing CO_2 by 7 Mton because three

Table 1
Overview of the Dutch energy mix and share of CO_2 emissions in 2017 (sources: CBS, 2018a, 2018b and Dutch Emissions Authority, 2017).

Energy resource in 2017	Share of the total energy mix in 2017	CO_2 emissions in 2017 in Megaton	CO_2 emissions in 2017 in percentage in energy fuels
	-	**163 Mton**	**-**
Energy sources	**100%**	**77.2 Mton**	**47.36%**
Fossil fuels of which			
• Oil	38.6%	24.7 Mton	31.99%
• Gas	41.2%	28.4 Mton	36.78%
• Coal	12%	28.5 Mton	36.91%
Total share fossil fuels: RES and CO_2 (Mton and %)	**92%**	**77.2 Mton**	**100%**
Renewable resources of which	**6.6%**	N/A	N/A
• Biomass	3.96%		
• Wind of which	1.66%		
- onshore	1.07%		
- offshore	0.58%		
• Solar	0.42%		
• Geothermal	0.34%		
• Biogas	0.48%		
• Hydropower	0.013%		
Nuclear	**1.6%**	**N/A**	**N/A**

new CFPP became operational in 2015 and 2016. Since 2017, there is once again an overall reduction of CO_2 emissions, which can be attributed to a lower share of coal in the energy mix (CBS, 2018b and 2019) and 2018 overall CO2 emissions are reduced by 14.5% in comparison to 1990.

The non-EU ETS emissions have performed much better in the Netherlands with respect to the necessary reduction of 20%. Between 2005 and 2016, the non-EU ETS emissions have been reduced by 12% in comparison to 1990, which corresponds to 13.6 Mton (Dutch Emissions Authority, 2017). An explanation for the difference in performance could be that EU ETS rights are transferable between member states. Overall, the ceiling of the available rights is lowered each year by 1.7% (2009/29/EC), adding up to 20% in 2020. Even if the Dutch companies buy and use more rights to legitimately produce more CO_2 emissions, other member states cannot and therefore the overall EU CO_2 emissions reduces according the EU goal.

However, another important development relating to CO_2 emission reduction took place in the Netherlands. In 2015, an environmental NGO – Urgenda – sued the Dutch State for not taking enough efforts to reduce its CO_2 emissions. According to Urgenda two elements were important: 1) on the basis of the best scientific knowledge available, CO_2 emission reductions must be increased to 25% in comparison to 1990, rather than 20% and 2) on the basis of current policies the estimations for CO_2 emissions reductions fell short of 25% in comparison to 1990. The court agreed to this and sentenced the Dutch State to 25% CO2 emission reduction by 2020 in comparison to 1990 (Urgenda I). This sentence was upheld by the Court of Appeals in October 2018 (Urgenda II). The Supreme Court is expected to rule in December 2019 on the issue in appeal. From a report of January 2019, it is estimated on the basis of current policy that a CO2 emission reduction of 21% will be realised by 2020 in comparison to 1990 (PBL, 2019). See Table 2 for a schematic overview of all EU and Dutch targets and the estimated achievements.

3. Applying the framework of policy mixes for sustainability transitions. The interplay of policy goals

As we have shown, sustainability policy in the Netherlands is aimed at three goals: CO_2 emission reduction, cost-effective measures and societal acceptance for the measures (EZ, 2016a, 2016b; Coalition Agreement, 2017; Climate Agreement, 2019). Since the Netherlands lags behind on increasing the share of RES to 14% and the reduction of CO_2 emissions to 20, but especially 25% is uncertain, the effectiveness of climate action to be undertaken to meet the targets for 2030 will be ever more important.

The role of CFPP in the Netherlands has been debated for several years now and earlier plans to close the remaining five have been delayed because the contribution thereof on CO_2 emission reduction has been questioned, and several reports investigating the financial consequences resulted in very different outcomes. At the same time, there was a substantial societal support for the closure of CFPP. Currently, phasing out coal is back on the agenda now that prognoses show that the Netherlands will not meet the Urgenda target. It has therefore once again become important to investigate whether the plan meets the policy goals.

Table 2
Overview of EU targets and Dutch achievements on energy efficiency, RES share and CO2 emissions.

	EU target	Translated for the Netherlands to:	Dutch Achievement (estimations for late 2020)
Energy efficiency	20%	482 Petajoule	520 Petajoule
Share of RES	20%	14%	12.2%
CO_2 emission reduction:			
EU	20%	–	21%
Dutch Urgenda	25%	–	21%

In this section we introduce and analyse how the idea arose and what policy process took place by means of the framework of policy mixes for sustainability transitions (Rogge and Reichardt, 2016). In 4.1 we apply the first step of the framework: policy strategy and goals. Section 4.2 focuses on step two, the policy process. In section 4.3 we discuss the policy strategy and proposed instruments on the basis of four characteristics: consistency, coherence, credibility and comprehensiveness. Section 4.4 discusses if and how the three policy goals can be met: 1) CO2 emission reduction; 2) cost-effectiveness of the measure and 3) societal acceptance of the measure. This step includes the description and analysis of the societal debate, to which we apply the advocacy coalition framework (Sabatier, 1988; Sabatier and Jenkins-Smith, 1993; Sabatier and Weible, 2007). In section 4.5 we present a brief, overall analysis of the policy process, strategy and instruments, leading to a final analysis and policy implications in section 5.

3.1. Step one: Policy strategy and goals: phasing out coal in the Netherlands

First and foremost, the plan to phase out coal in the Netherlands is implemented in order to significantly reduce CO_2 emissions. According the Dutch government, as much as 12 Mton CO_2 could be reduced (Coalition Agreement, 2017). The plan to phase out coal is part of a larger policy package, aiming at 49% CO_2 emission reduction by 2030 in comparison to 1990 (Climate Act). Policy pathways to reach this target have to meet two additional policy goals: 1) cost-effectiveness and 2) societal acceptance. These three elements will be discussed in section 4.4. Below we will discuss the introduction of policy instruments to enable the coal-phase out.

These two instruments concern: 1) carbon price on electricity production and 2) a prohibition on coal-combustion per 2030. Moreover, coal-combustion is currently part of the EU emission trade system (EU ETS) and the developments at the EU level are important here as well.

The EU ETS concerns a system for the production of carbon and regulates a reduction of 20% by 2020 and at least of 40% by 2030 in comparison to 1990, by putting a ceiling on the ETS rights in the market. Until 2020 the rights will be lowered each year with 1.7% and until 2030 with 2.2%. Furthermore, the EU ETS puts a price on carbon emissions. Since 2017, the EU ETS price significantly increased, therefore rendering carbon emissions less attractive and renewable options more attractive. However, the EU recognizes can the EU ETS price can be too volatile and has proposed a new system in order to stabilize the price and prevent excesses by means of the Market Stability Reserve. This Reserve functions in anticipation of the revision of the EU ETS for the period between 2020 and 2029. It regulates the option to adjust the supply of allowances, by placing in or releasing allowances from the reserve. The reserve was established for the period of 2019–2020 as surpluses, e.g. allowances that were not auctioned, decreased the price of ETS rights as the supply was higher than the demand. By allocating 900 million allowances for 2019–2020 into the reserve, the price of ETS rights increased, pressuring companies to reduce its CO_2 emissions. However, the Market Stability Reserve arranges for the possibility to place more allowances in the reserve, and whether this will be done is announced each year on 15 May. Therefore, it is possible to place 'coal' allowances into the reserve.

At the Dutch level, from 2020 a national minimum carbon price for electricity production will be implemented – equal to 12.3 €/t CO_2 and gradually increasing to 31.9 €/t in 2030. This minimum price works in concert with the EU ETS price. If the ETS price is lower than the suggested minimum price per ton CO_2, the ETS price will be increased to minimum price ceiling. To illustrate, in case the EU ETS price concerns 16 €/t CO_2 in 2030, the minimum price will be 31.9 €/t, and the total price will be 31.9 €/t CO_2. In case the EU ETS price is higher than 31.9 €/t CO_2, the Dutch minimum price will not affect electricity production prices. This way, all electricity producers know what they can at least

expect; the EU ETS may be volatile and be higher than 31.9 €/t CO_2, but on the basis of the minimum price, investment pathways for renewables can be developed based on a certain minimum carbon price.

In May 2018, the Dutch government proposed a new Act to realize the coal phase out, by means of a prohibition on coal-combustion for energy production purposes. Moreover, it entailed a timeframe for the plants, the two plants from the 1990's can no longer produce electricity with coal-combustion per 2025 and all coal-combustion would be entirely prohibited by 2030 (Introduction Prohibition to Coal Act, 2019). Although the closure of the plant near Amsterdam is expedited due to Urgenda II, and is to be closed per 1 January 2020. The Council of State – a governmental body that advices the State on legislative proposals – found the proposal overall fitting. With respect to the argument of the coal-fired owners, that the proposal would infringe on their ownership rights, was thrown over as the Council of State found that the proposal meets a public interests (climate change mitigation) and showed that a sufficient balance and consideration had been given to ownership rights vis-à-vis the public interest involved (Advice Council of State, 2019). Moreover, the minister of Economic Affairs and Climate Policy argued that the plant itself does not have to be dismantled and if possible, the owners could and should rebuilt it to a biomass plant.

With respect to financial damages to the CFPP owners, the Act contains a clause depicting possible rewards only for owners with substantial damages in comparison to the other owners of CFPP. Relating the damages to the each other practically renders a reward impossible, therefore keeping societal costs of this solution low. The proposed legislation has been adopted by Parliament and is under discussion at the Senate. Owners of CFPP, however, may appeal to court with respect to the damages.

3.2. Step two: policy process

The idea first arose in 2013, when the public-private Energy Agreement was closed. Herein CFPP were made an integral part of the discussions on the Dutch energy transition for the first time and it was decided to close the five plants that were built in the 1980's. However, almost immediately the ACM – the Dutch competition regulator – published an advice on this specific plan of the Energy Agreement and concluded that competition regulation prevented industrial partners of making this sector-wide agreement to close the CFPP. The ACM moreover found that the societal costs would not outweigh the societal benefits (ACM, 2013, Gerbrandy, 2015, 2017 and 2018). This did not stop the movement, and today these five plants are closed. One of the CFPP was reported to have closed because it was no longer cost-effective. Others were closed because of technical incidents, including fires. Only five CFPP remain today, two from 1990 and 1994, one from 2015 and two from 2016. These latter three plants coincided with the green plans stemming from the Energy Agreement, but given the lengthy strategic and permit decision-making processes, these processes were started well before 2013.

In 2015, after the first Urgenda judgement, the idea arose to close the two CFPP from the 1990's. The Energy Report and Agenda (2016a and b) specified sustainable action further, focusing on the reduction of CO_2 emissions. However, this led to a decision of the minister of Economic Affairs in January 2017 to focus on other activities than the closure of the remaining CFPP to meet the reduction target (Dutch Emissions Authority, 2017). In October 2017, upon introducing the "most sustainable Dutch policy ever", the new coalition announced the remaining five CFPP would be closed, the oldest two by 2025 and the remaining three by 2030. Through this closure, an estimated 12 Mton CO_2 emissions can be reduced (Coalition Agreement, 2017). With the Urgenda judgement from 2018, confirming a 25% CO_2 emission reduction target, the Minister of Economic Affairs and Climate Policy has announced to expedite the process and to close at least one of the oldest two by January 1st, 2020. The final judgement of the Supreme Court is expected in December 2019.

As said above, the former Minister of Economic Affairs has changed its opinion during the course of the discussions. Although this Minister was not a direct signing partner to the Energy Agreement, as part of the national government, they were *de facto* bound by the agreements made. However, upon the negative assessment of the ACM, the Minister decided not to close the CFPP, but to look for alternative solutions to reduce CO_2 emissions. As a result, he chose to mandate an efficiency increase in energy production. In the meantime, the Netherlands signed the Paris Agreement, faced the 'Urgenda' judgements and witnessed the only Carbon Capture and Storage (CCS) plan (ROAD) in the Netherlands fall through. After increasing societal pressure, eventually the oldest five plants were closed in 2016 and 2017. With respect to the remaining five CFPP, in January 2017 the Minister of Economic Affairs decided to focus, again, on alternatives to closing them. This decision was based on elaborate research into several elements such as job opportunities and CO_2 emission reductions (EZ, 2017).

However, with the new coalition formed after elections in March 2017, the political view changed drastically. In the coalition agreement of October 2017, it was announced that the CFPP were to be closed by 2030 at the latest. In the meantime, whilst the public-private, the successor of the Energy Agreement, Climate Agreement was being negotiated, Urgenda II in appeal won again and the State was sentenced to reduce its CO_2 emissions with 25% by 2020 in comparison to 1990. This led to an increasing importance of a coal phase out and the importance of a successful Act to prohibit coal-combustion. The proposed Act has therefore been adopted by Parliament in a record time: only 14 months after its introduction. Currently, the proposal is under evaluation at the Senate level.

3.3. Characteristics of the strategy and the instruments

The last and third step of this policy framework concerns an analysis of the proposed instruments by means of four characteristics: consistency, coherence of processes, credibility and comprehensiveness. These characteristics can be analysed for the purpose of strategy analysis and instrument analysis. Consistency illustrates if and how the different instruments are aligned with other. Coherence relates to systematic policy making and implementation processes towards the achievement of policy objectives. Credibility concerns the extent to which the policy mix is believable and reliable (Newell and Goldsmith, 2001). Finally, comprehensiveness refers to how extensive and exhaustive the decision-making process was and the proposed instruments are.

With respect to consistency, the minimum carbon price and the EU ETS are aligned. After all, the minimum carbon price only becomes relevant in case the EU ETS does not meet the predefined price. This way, electricity producers will always know the minimum price of carbon, decreasing changes of volatile EU ETS prices. The UK's Carbon Price Floor entailed a similar system: the EU ETS allowance price topped by the Carbon Support Price. This price increased annually, to £30/tCO2 by 2020. This therefore increasing the carbon price significantly. The Dutch minimum price will only rise to 31.9 €/t CO_2 by 2030. Although it is consistent to introduce a carbon minimum price to correct a low EU ETS allowance price, it is also rather likely that that the EU ETS allowance price increases more than the Dutch minimum price (PBL, 2019), raising questions to its effectiveness.

In terms of consistency of policy and the processes leading towards the final policy, over the years, the specific plans towards a Dutch coal-phase out differed greatly. Especially the decisions in 2016 of the former minister of Economic Affairs shows an inconsistent policy process towards a decision-making. The policy processes and the political opinion is further analysed in section 4.4.3. Yet, with the newly installed coalition in 2017, the final decision was made: all coal would be phased out by 2030. Only the closure of the 1994 plant was expedited and therefore subject to differing policy. At the same time, this plant has been under debate for a longer period of time than the plants that became operational in 2015 and 2016.

However, especially with respect to credibility, the fact that financial damages for CFPP owners are unlikely, as the damages must be related to each other, raises questions of credibility. Moreover, the in parliamentary debate on the Act to ban the use of coal, the minister presented different answers with respect to future use of the CFPP. Once he mentioned they could be rebuilt towards biomass plants and at other times he acknowledges that biomass at that capacity is unlikely. This renders the future use of the plants uncertain and damages more likely. At the same, the Act does not provide for possible damages rewards. It is rather likely for the owners of the plants to appeal to this provision.

This also raises some questions with respect to comprehensiveness of the decision-making and the proposed instruments. It especially comes up whether the lack of damages has been thought through as potential use of future is rather uncertain. It is possible that these questions can be answered simply by introducing financial damages for the plant owners, if only for the three most recent ones.

3.4. Analysis of the policy goals and instruments: CO_2 emission reduction, cost-effectiveness and societal acceptance of a coal-phase out

3.4.1. CO_2 emission reduction

First and foremost, it is important that phasing out coal will lead to a CO_2 emission reduction. It is often argued that a coal phase out would only lead to a net reduction of CO_2 in the Netherlands, whilst increasing emissions elsewhere in Europe. This has to do with the balance between demand and supply and the fact that the Netherlands will not be able to immediately replace the production capacity of CFPP with renewable electricity production installations, as the energy consumption is also still growing. Therefore, the Netherlands will have to increase its import from other countries, where energy sources may not necessarily be cleaner, e.g. less CO_2 emissions. In many other countries, a coal phase out plan is accompanied by the intention to increase the share of natural gas in the energy mix, but alas, this is not an option for the Netherlands, as the government has decided – due to Groninger earthquakes – to phase out natural gas consumption in stages, latest by 2050 (EZK, 2018).

It is therefore likely that the Netherlands will import more electricity from other EU member states, of which it is likely that this is produced by coal or gas, therefore increasing the CO_2 emissions in the other member state, e.g. causing a 'waterbed effect'. Currently, under the EU ETS system, this is possible. The extra reductions accomplished in one country, can give rise to higher CO_2 emissions elsewhere if the ETS rights are transferred. Only if the rights are taken out of the market, for instance because a government decided to purchase them for the remainder of the phase, will a net CO_2 emission reduction occur in Europe.

In a report of May 2019 (CE Delft, 2019) it is estimated that a closure of three CFPP by January 2020 will lead to a net CO_2 emission reduction of 9 Mton, increasing to 11 Mton by 2025 and decreasing to 9 Mton by 2029. If the extra CO_2 emissions due to import are taken into account (European perspective), a net CO_2 emission reduction of 4–6 Mton occurs between 2020 and 2029. The report further notes that a 'waterbed effect' will not arise, given the rules under the market reserve. From 2021 onward, the ETS ceiling will lower faster, with 2.2% annually. Under this system, the reserve will be regulated differently, and it is unclear as of 2022 whether a 'waterbed effect' will occur or not. The report further takes into account plans from other member states to phase out coal, especially Germany. If Germany also phases out coal, this will have an effect on the net reduction in the Netherlands, and lowering it slightly (CE Delft, 2019).

However, taking into account the pressure on other member states due to the Dutch import, an average of 5 Mton CO_2 emissions will be reduced annually in the Netherlands. In 2018, the Netherlands produced 161 Mton CO_2 emissions; an average of 5 Mton therefore equals 3.1% of all CO_2 emissions. If the European perspective is not taken into account, the net Dutch reduction is 9 Mton, equalling 5.6%. Added to the estimated 21% CO_2 emission reduction, the CO_2 emission reduction can be estimated at 24.1% from a European perspective and 26.6% from a Dutch perspective. The difference of 4 Mton will be produced elsewhere in Europe. However, we must note explicitly that this concerns the estimation for the closure of three plants, whilst the minister of Economic Affairs and Climate Policy has only announced the closure of one plant by January 1, 2020. The actual CO_2 emission reduction will therefore be lower.

3.4.2. Cost-effectiveness

Phasing out CFPP may bring about costs. At the same time, there may be benefits. The balance between these two can be measured through the quantification of expected changes in the energy mix and prices balanced by the social cost of carbon (SCC), or the quantification of benefits of each avoided ton CO_2 emissions. Assuming that CO_2 emissions will eventually lead to climate change and thus bring about costs due to more extreme weather, the mitigation of climate change can be translated into financial benefits (Van den Bergh and Botzen, 2014 and 2015). Given the contribution of CFPP to CO_2 emissions, the closure may lead to the reduction of CO_2 and thus may have a net positive financial effect. In 2015 (ECN, 2015a) and 2016 (SEO, 2016) two reports have been published containing societal cost-effectiveness and cost-benefit analyses for the closure of the five remaining CFPP.

The main objective of the 2015 study by ECN is to quantify the effects of the closure on CO_2 emissions, electricity prices, the generation mix, cross-border trade in electricity, costs of electricity production and cost-effectiveness of CO_2 emission reduction. This report studies the closure of CFPP in two scenarios: by 2017 and by 2020. Alternative electricity generation will be realised with gas and imported electricity. This study does not translate the costs or benefits to individual parties.

With respect to the effects on CO_2 emissions, the closure of CFPP can reduce the emissions with 15 Mton a year. In a scenario in which these plants close by 2020, the cost-effectiveness of this reduction is estimated at €16 per reduced ton CO_2 emissions. In the 2017 scenario, a reduced ton of CO_2 costs €21. In both scenarios the costs will increase by 2030 to €35 per ton CO_2 emissions. Overall, although the CO_2 emissions will decrease substantially in the Netherlands, at the EU level the emissions will remain the same given the EU ETS ceiling and the fact that the EU ETS rights can be transferred. This means that reduced CO_2 emissions in the Netherlands due to the closure of the coal-fired power plants will be offset by increased emissions elsewhere in the EU. This is why the ECN study did not quantify the benefits of reduced CO_2, and instead did a cost-effectiveness analysis of how much it costs to reduce a unit of CO_2 through the closure of the coal-fired power plants. Moreover, due to the fact that the installed capacity has to be met elsewhere, the electricity price will increase by €2 to €4 per MWh. In total, the costs of this plan will cost €800 million annually without decreasing CO_2 emissions at the European scale.

The 2016 SEO study builds forth on this study, and quantifies the societal costs and benefits of the closure of the five CFPP by 2020. The alternative scenario, against which the 2020 scenario is measured, concerns the closure of the plants after 2034, when the technical lifespan of the plants expires (SEO, 2016). The SEO report assumes that the electricity prices will increase by €2 to €4 per MWh, which is the same assumption made in the ECN report.

The SEO report shows, in contrast to the ECN report, an overall net societal benefit of €4.7 billion in 2020 upon the closure of the CFPP. This net benefit is derived from the avoided greenhouse gas emissions, CO_2 and others, minus the increased costs for both energy consumers and producers. The effects of the avoided CO_2 emissions on the environment and health lead to a societal benefit of €9.8 billion according to the SEO. On the other side, the fact that gas and imported electricity will lead to an increased electricity price will cost energy consumers €3.1 billion and energy producers €1.9 billion. The latter arises from a balance between the loss of profit from the closure of CFPP and increased import of electricity with the increased profit of the gas-fired plants and a higher electricity price, also for RES. Subtracting the total costs from the total

benefits leads to a net benefit of €4.8 billion.

The two reports lead to very different outcomes, with the ECN assuming an increase in societal costs from closure of the coal-fired power plants and the SEO assuming an increase in societal benefits. They also have different assumptions with respect to the potential reduction of CO_2 emissions: whereas the ECN expects the EU wide emissions to remain the same, the SEO does assume that aggregate EU wide CO_2 emissions can be reduced. This has to do with the interpretation of the EU ETS and future expectations about its effectiveness. The ECN assumes that the EU ETS will be a well-functioning system, with a proper emissions ceiling, which implies reduced CO_2 emission are offset by increases elsewhere when the initially reduced CO_2 permits enter as a supply of emission rights on the EU ETS market. The SEO on the other hand does not expect the EU ETS to function properly. The reason is that adding permit supply to the ETS market from reduced CO_2 emissions does not necessarily mean these rights are demanded and used for emissions elsewhere, in case there is a lack of scarcity of emission rights. In such a malfunctioning of the EU ETS there are benefits of avoided climate change impacts with every reduced ton of CO_2 emissions.

The question here arises which assumption is most realistic. Although some faults with the EU ETS system have been reported (De Perthuis and Trotignon, 2014) and the price mechanism did not meet the initial expectations, the continuous adjustment of the system provides opportunities for improvement. In most periods of the EU ETS there was a positive price of CO_2 permits, which means that some degree of scarcity of permits was present. Since the EU has announced to lower the target for 2030 and to lower the number of free emissions rights, the price has increased considerably. This was not foreseen in the SEO report and makes the rather high prediction of the societal net benefit of €4.7 billion of the SEO less realistic.

In the report of May 2019 (CE Delft, 2019), costs of phasing out three CFPP are estimated from three perspectives: the owners, the consumers and the government. The calculations in the report show an estimated € 2 billion loss of income for the owners of the CFPP, in case of a closure by January 1, 2020. If the phase out of coal leads to an actual closure of the CFPP, the Dutch government will receive back € 1.2 billion in subsidies that were allocated for the co-creation of biomass in the plants. Of course, in case the plants will completely shift to biomass, this subsidy won't go back to the government. Moreover, if the three newest CFPP do rebuild to a biomass plant, PBL has estimated that demand on biomass will increase prices, also of the electricity generated. This was not yet taken into account in the SEO and ECN reports. Costs may therefore be higher. Right now, the most specific estimation of increased electricity costs concerns the prediction that the wholesale market prices will be affected and increase by 5%, leading to an overall increase of € 15 to the energy bill of household end-consumers in the Netherlands. This will be higher in case Germany also phases out coal.

3.4.3. Societal support for phasing out coal

There is a quite a lot of support for the plan to close the remaining CFPP in the Netherlands. The societal debate is analysed through the advocacy coalition framework (Sabatier, 1988; Sabatier and Jenkins-Smith, 1993; Sabatier and Weible, 2007) which divides parties in coalitions. Two important coalitions can be distinguished here: those who in favour a coal-phase out and those who are against a coal-phase out.

The pro-closure coalition is formed by a number of parties, including academia, branch specific parties and energy experts, citizens, NGOs and interests groups like Greenpeace, but also (semi) governmental actors like the Social and Economic Council (SER) and the municipality of Amsterdam. Initially, also the parliament, amongst which parties GroenLinks and D66, and legislative branch of the national government were part of this coalition. The pro-closure coalition displays a broad support for closure of CFPP throughout a broad sample of society. The reasons for their support may differ but at heart it shows how the topic is important.

Although the 'Urgenda' judgement did not mention CFPP specifically, a group of 64 professors of Dutch universities, aiming to put the topic back on the agenda, wrote a letter to the Ministry of Economic Affairs in November 2015, urging to close the CFPP considering their large share in the CO_2 emissions. One plant received particular attention: the Hemweg plant, near Amsterdam. Having been built in 1994, this plant is relatively polluting. In March 2017, Vandebron – a new renewable energy supplier - offered €1 million to Nuon, the owner of the Hemweg plant, for its closure. In response to this, the municipality of Amsterdam, Triodos Bank, Foundation Doen[1] and an anonymous bidder all offered €1 million, resulting in a total offer of €5 million (Wij Willen Hemweg). Simultaneously, a crowdfunding, to which 42,180 citizens contributed was started to raise the offer even more. This crowdfunding was supported by a second letter of a group of 90 professors to pressure the Minister of Economic Affairs to close all CFPP. However, the Hemweg plant remains open to this date. With the coalition agreement of October 2017, and the new intention to close the CFPP, a decision with respect to the phase out was taken.

Not agreeing the conviction of Urgenda I, the Dutch state appeal. In October 2018, the court of appeal in The Hague ruled on this Urgenda appeal. The Dutch government argued that the court in first instance had violated the separation of powers, by binding the Dutch government to a 25% CO_2 reduction by 2020. By means of appeal, the Dutch government hoped to have this ruling overthrown. The court of appeal however ruled in favour of Urgenda once again, although using different arguments, and committed the Netherlands to the 25% reduction target. On the basis of fundamental human rights, the protection of life, the court of appeal argued that the government has the responsibility to protect its citizens, including from catastrophic natural disasters caused by man-made climate change. At the time of the ruling, a 13% CO_2 reduction had been realised. In court, the States' lawyers argued on the basis of predictions that a further reduction would be realised, accounting for 19 to 27%. Clearly, the court of appeal was not satisfied and reconfirmed the hard target of 25% (Urgenda II, 2018).

With this ruling, both the execution of the Energy Agreement and the negotiations on the Climate Agreement became pressured by the additional, quite substantive goal of 5% extra CO_2 emissions reduction, that no one truly counted on. Once again, the discussion on the CFPP was revisited, this time to close the plants per 1 January 2020.

The debate is also clearly marked by a no-coalition, whose arguments are aimed at discrediting sustainability or climate change, financial and energy considerations, relating to the energy mix and the energy demand. Part of this coalition is the energy company Nuon (now Vattenfall), as the owner of one the CFPP. They do not say they are against the closure of the CFPP, but require a compensation of €55 million for the closure of the CFPP and argue that the Dutch government is responsible for this amount. This approach suggests there may be more cost-effective solutions to bring down CO_2 emissions. This amount has been disputed by an energy expert and is estimated at €10 million.

The no-coalition is further made up by several governmental parties, such as the competition regulator ACM, political parties, including the liberal party (VVD). However, because the policy processes show inconsistent elements, as illustrated above and concluded in section 4.3, political opinion has differed greatly. The current political coalition has decided to introduce the Prohibition to Coal Act, and within that coalition, VVD is the biggest party. So, eventually, also the VVD supported the coal phase-out. At times, the former Ministry of Economic Affairs, was part of the no-coalition. In September 2013, the ACM was firmly against the closure of the CFPP as agreed upon in the Energy Agreement because competition regulation would not allow for it, but also the social costs were deemed too high. Of course, since then those five CFPP have been closed. The ACM has not yet responded to the plans presented in the coalition agreement to close the five remaining plants. This may be

[1] Dutch verb for 'do'.

explained by the changing attitude of the energy companies involved. In 2013, they requested an independent advice from the ACM, who at that time, argued that an agreement to close the CFPP was not competition regulation compatible. Today, the plan to close the five remaining plants is on the basis of a forced closure on the basis of governmental policy and this has not led to the same resistance from energy companies.

In conclusion, overall there is a lot of societal support for the coal phase-out. In fact, one of the most important factors leading to the coal phase-out and the Prohibition to Coal Act were Urgenda judgments (2015 and 2018), forcing the government to undertake additional measures to meet the 25% CO_2 emission reduction target. As an NGO sued for more climate action, this can be considered be part of societal support for climate action, specifically the coal phase-out. More often, policy documents and newspaper article point towards societal support. At this time, the only the three owners of the CFPP fight against the coal phase-out. However, what stands out is that they have accepted the coal phase-out but are willing to sue the Dutch government for reasonable damages, as this not part of the Prohibition to Coal Act (Telegraaf, 2019).

3.5. Analysis of the policy strategy, instruments and goals

The Netherlands aims at an entire coal phase-out by 2030. To realize this goal a Prohibition to Coal Act has been proposed and a minimum carbon price for electricity production will be introduced. This price will be aligned with the EU ETS allowance price and increase if necessary to the predetermined minimum price. According to the government, the coal phase-out can potentially reduce Dutch CO_2 emissions by 12 Mton. Several reports have been published analysing the potential CO_2 emission reduction of the coal-phase out. These reports do not offer a conclusive answer. There are several uncertainties with respect to the actual possibilities to rebuild a CFPP to a biomass plant and how much subsidy that will cost and how that will increase the electricity prices. Estimations moreover ultimately vary depending on external factors, such as other coal phase-outs as well. At the same time, it remains unclear how much CO_2 can actually be reduced, in the Netherlands and the EU as a whole. There is no conclusive answer. It is possible that estimated price tag may influence the publics support for this plan, especially if the reduction of CO_2 emissions is limited.

4. Conclusion and policy implications

Above we have discussed the Dutch sustainable energy policy, which has been given an impulse in October 2017 after the presentation of the coalition agreement that entails rather ambitious plans. It concerns the most elaborate and coherent policy to date. Given the Urgenda cases, the Dutch government is under ever greater pressure to cut CO_2 emissions, within the remaining time frame of one year. Since the debate on phasing out coal was already on going, an earlier closure of the plant per 1 January 2020 seems like a natural fit. It however does not take into account that Dutch energy consumption is likely to remain the same and as RES produced domestically will not immediately make up for the emerging gap, questions with respect to the actual CO_2 emission reduction arise. Either electricity will be imported from other EU countries, which is not necessarily cleaner, or Dutch gas can be used to make up for the difference. However, given the ambition to significantly cut back on Groninger gas, this is unlikely, rendering the chances of the import of gas – most realistically from Russia, higher, moreover because Germany has announced to phase out coal too. This creates its own issues with respect to (potential) affordability and energy security. All of these options can allow for carbon leakage; in order to cut down on CO_2 within one member state, another member state's production will increase.

The EU ETS system allows for this type of carbon leakage to occur. The benefit of the EU ETS is the emission ceiling, which is lowered over the course of each decade, firstly to 20% and by 2030 to 40%. But the EU ETS does not stop carbon flowing from one country to the other. That means that other countries, who are also subjected to the EU ETS, have to cut their emissions more.

With several member states planning to – eventually – phase out coal from its energy mix, an overall EU strategy may be necessary to time and coordinate the phase out. Although freely allocated EU ETS rights will be available in much more limited numbers, the market of rights still allows for carbon leakage. If Germany, Finland and the Netherlands all phase out its coal at the same time, pressure could increase on Central and Eastern European member states, states that may be less likely to change their energy mix from fossils to renewables in the first place and whose coal plants might be less modern and sustainable than the new Dutch plants. However, given the fact that EU policy on specific energy sources requires unanimity, the EU may be limited in coordinating coal-oriented policy. Possibilities to issue EU policy are therefore subject to further research.

Because coal is part of several member states' energy policy and due to the European nature of the carbon leakage issue, it deserves recommendation to develop an EU strategy with EU ETS aligned with phasing out coal in European member states, meaning that if and when a CFPP is shut down, the EU ETS cap lowers alongside of the reduced emissions in the next phase, in order to prevent the carbon to be produced elsewhere. This way, the carbon leakage is guaranteed only temporary and leads a member states' strategy to reduce its emissions by means of phasing out coal to an EU wide CO_2 emission reduction. This could for instance be realised by taking up "coal" ETS into the Market Stability Reserve when a CFPP is closed, instead of these rights being transferable. Depending on the price of the ETS, more rights can be absolved into the Reserve or taken out. This limits additional costs as governments, or societal initiatives are not burdened with buying the 'former coal' ETS rights. This would require the EU to formulate strategy specifically based on coal as an energy resource. It will furthermore force member states to create a coordinated policy with RES, instead of accepting carbon leakage and added pressure elsewhere.

Although closing the CFPP meets broad societal and political support and indeed contributes to a CO_2 reduction in the Netherlands, although not to the extent the government expects it, it also puts pressure on realizing three other goals: the necessity of creating more renewable energy, the aim to be less dependent on domestic gas production and the necessity to avoid carbon leakage. Phasing out CFPP should therefore be considered in concert with the reduction of gas production - although this is for societal reasons - and the increase in the share of RES. Without such a coordinated policy, solely focusing on the reduction of CO_2 emissions in the most cost-effective manner, carbon leakage may prevail, ultimately contributing limitedly to the overall mitigation of climate change.

Author contributions statement

The authors have different backgrounds: law (Dutch and European administrative law and energy law), governance and political science and economics. This interdisciplinarity shows in the article as it contains legal, governance, societal and economics sections. Sanne Akerboom: Conceptualization, Methodology, Formal analysis, Investigation, Writing- Original draft preparation. Wouter Botzen, Anoeska Buijze, Ank Michels and Marleen van Rijswick: Conceptualization, Methodology, Writing, Reviewing and Editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

2009/28/EC, 2009/28/EC, Directive 2009/28/EC of the European Parliament and the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources and Amending and Subsequently Repealing Directives 2001/77/EC and 2003/30/EC.

2009/29/EC, 2009/29/EC, Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 Amending Directive 2003/87/EC So as to Improve and Extend the Greenhouse Gas Emission Allowance Trading Scheme of the Community.

2010/75/EU, 2010/75/EU, Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on Industrial Emissions (Integrated Pollution Prevention and Control).

2012/27/EU, 2012/27/EU, Directive 2012/27/EU of the European Parliament and the Council of 25 October 2012 on Energy Efficiency, Amending Directives 2009/125/EC and 2010/30/EC and Repealing Directives 2004/8/EC and 2006/32/EC.

2018/2001/EU, 2018/2001/EU, Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the Promotion of the Use of Energy from Renewable Sources.

2018/2002/EU, 2018/2002/EU, Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 Amending Directive 2012/27/EU on Energy Efficiency.

ACM, 2013. ACM, Notitie over Sluiten 5 Kolencentrales in SER Energieakkoord. September 2013.

Advice Council of State, 2019. *Kamerstukken II* 2017-2018 35 167 Nr. 4, Advies Raad Van State 18 March 2019.

Backes, ChW., 2018. De Klimaatwet – de meest ambitieuze of de meest minimalistische ter wereld? TBR 2019 10, 989–998.

Baker, D., McLelland, J.M., 2003. Evaluating the effectiveness of British Columbia's environmental assessment process for First Nations' participation in mining development. Environ. Impact Assess. Rev. 23, 581–603. https://doi.org/10.1016/S0195-9255(03)00093-3.

BAT reference document, 2017. JRC Science for Policy Report, Best Available Techniques Reference Document for Large Combustion Plants, Industrial Emissions Directive 2010/75/EU.

CBS, 2018a. Center for Big Data Statistics, Share of Renewable Energy at 6.6 Percent. https://www.cbs.nl/en-gb/news/2018/22/share-of-renewable-energy-at-6-6-percent. (Accessed 6 November 2019).

CBS, 2018b. Center for Big Data Statistics, CO2 Emissions in 2017 the Same as in 1990. https://www.cbs.nl/nl-nl/nieuws/2018/37/co2-uitstoot-in-2017-gelijk-aan-die-in-1990. (Accessed 6 November 2019).

CBS, 2019. Center for Big Data Statistics, Slight Drop in Greenhouse Gas Emissions, 9 May 2019. https://www.cbs.nl/en-gb/news/2019/19/slight-drop-in-greenhouse-gas-emissions. (Accessed 6 November 2019).

CE Delft, 2019. CE Delft, Effecten Van Sluiting Drie Extra Kolencentrales. Delft, May 2019.

Climate Act, 2018. *Kamerstukken II* 2017-2018 24 534 Nr. 10, Voorstel Van Wet, Klimaatwet, 28 June 2018.

Climate Agreement, 2019. Klimaatakkoord, Letter of the Minister of Economic Affairs and Climate Policy to Parliament Offering the Climate Agreement, 28 June 2019.

Coalition Agreement, 2017. Coalition Agreement, Trust in the Future. October 2017.

COM/2014/015, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A Policy Framework for Climate and Energy in the Period from 2020 to 2030,/*COM/2014/015 Final.

De Perthuis, C., Trotignon, R., 2014. Governance of CO_2 markets: lessons from the EU ETS. Energy Policy 75, 100–106. https://doi.org/10.1016/j.enpol.2014.05.033.

Dutch Emissions Authority, 2017. Dutch Emissions Authority, *Voortgang Emissiehandel 2017, Feiten en cijfers over emissiehandel in Europa en Nederland*, 4 September 2017.

ECN, 2015a. ECN, Effecten van het vervroeg sluiten van de Nederlandse kolencentrales. October 2015.

ECN, 2015b. ECN, PBL, CBS, Nationale Energieverkenning 2015, 2015.

ECN, 2017. ECN, CBS, Planbureau voor de Leefomgeving en Rijksdienst voor ondernemend Nederland. In: Nationale Energieverkenning 2017, Amsterdam/Petten, 2017.

EEA, 2018. European Environment Agency, Primary energy consumption by fuel, published 21 December 2018. https://www.eea.europa.eu/data-and-maps/indicators/primary-energy-consumption-by-fuel-6/assessment-2. (Accessed 6 November 2019).

EIA, 2016. International Energy Agency, Recent Trends in the OECD: Energy and CO_2 Emissions, 2016.

Eurostat, 2017. Eurostat, share of energy from renewable sources. http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_ind_ren&lang=en. (Accessed 6 November 2019).

EZ, 2016a. Ministry of Economic Affairs, Energy Report – Transitioning towards Sustainability. January 2016.

EZ, 2016b. Ministry of Economic Affairs. Energy Agenda. December 2016.

EZ, 2017. Ministry of Economic Affairs, Letter to Parliament about Coal-Fired Plants, 19 January 2017.

EZK, 2018. Ministry of Economic Affairs and Climate Policy, Letter to Parliament Including Decision Groningen Gas Exploitation 2018-2019. EZK, 14 November 2018.

EZK, 2019a. Ministry of Economic Affairs and Climate Policy, Letter to Parliament Offering the Report of the Environmental Assessment Agency on Short Estimations for Emissions and Energy in 2020, 25 January 2019.

EZK, 2019b. Ministry Economic Affairs and Climate Policy, Letter to Parliament about the Extra Measures to Meet Urgenda Case, 18 April 2019.

Gerbrandy, A., 2015. Addressing the legitimacy problem for competition authorities taking into account non-economic values: the position of the Dutch competition authority. Eur. Law Rev. 5, 769–781.

Gerbrandy, A., 2017. Solving a sustainability-deficit in European competition law. World Compet. 40 (4), 539–562.

Gerbrandy, A., 2018. Klimaatakkoord(en) en het mededingingsrecht. In: Aal, C.S., Beijer, M.P., Timmerman, W.G., Van der Veer, R. (Eds.), Klimaatbeleid in wetgeving en akkoorden. Den Haag: Raad van State, 55-28.

Heinrichs, H.U., Markewitz, P., 2017. Long-term impacts of a coal-phase out in Germany as part of a greenhouse gas mitigation strategy. Appl. Energy 192, 234–246. https://doi.org/10.1016/j.apenergy.2017.01.065, 15 April 2017.

Introduction Prohibition to Coal Act, 18 March 2019. Kamerstukken II 2017-2018 35 167 (2). Voorstel van Wet.

Lund, P.D., September 2017. Implications of Finland's plan to ban coal and cutting oil use. Energy Policy 108, 78–80. https://doi.org/10.1016/j.enpol.2017.05.043.

Matland, R.E., 1995. Synthesizing the implementation literature: the ambiguity-conflict model of policy implementation. J. Public Adm. Res. Theory: J-PART 5 (2), 145–174. https://doi.org/10.1093/oxfordjournals.jpart.a037242.

Newell, S.J., Goldsmith, R.E., June 2001. The development of a scale to measure perceived corporate credibility, 2001 J. Bus. Res. 52 (3), 235–247. https://doi.org/10.1016/S0148-2963(99)00104-6.

PBL, 2019. Planbureau voor de Leefomgeving, Kortetermijnraming voor emissies en energie in 2020. Zijn de doelen uit de Urgenda-zaak en het Energieakkoord binnen bereik? January 2019.

Rentier, G., Lelieveldt, H., Kramer, G.J., 2019. Varieties of coal-fired power phase-out across Europe. Energy Policy 132, 620–632. https://doi.org/10.1016/j.enpol.2019.05.042. September 2019.

Rogge, K.S., Reichardt, K., 2016. Policy mixes for sustainability: an extended concept and framework for analysis. Research Policy 45 (8), 1620–1635. https://doi.org/10.1016/j.respol.2016.04.004, 206.

Sabatier, P.A., 1988. An advocacy coalition framework of policy change and the role of policy-oriented learning therein. Policy Sci. 21 (2/3), 129–168. https://doi.org/10.1007/BF00136406.

Sabatier, P., Jenkins-Smith, H., 1993. The advocacy coalition framework: assessment, revisions and implications for scholars and practitioners. In: Sabatier, P., Jenkins-Smith, H. (Eds.), Policy Change and Learning: an Advocacy Coalition Approach. Westview Press, Boulder, CO, pp. 211–235.

Sabatier, P., Weible, C., 2007. The advocacy coalition framework: innovations and clarifications. In: Sabatier, P. (Ed.), Theories of the Policy Process. Westview Press, Boulder, CO, pp. 189–222.

Sadler, B., 1996. International Study of the Effectiveness of Environmental Assessment – Final Report. Environmental Assessment in a Changing World: Evaluating Practice to Improve Performance. Canadian Environmental Assessment Agency, Ottawa.

SEO, 2016. SEO Economisch Onderzoek, Sluiting kolencentrales, analyse van de maatschappelijke kosten en baten. April 2016, Amsterdam.

Shearer, C., Ghio, N., Myllyvirta, L., Yu, A., Boom, Nac T., Bust, 2016. Tracking the Global Coal Plant Pipeline. CoalSwarm, Greenpeace, and Sierra Club. March 2016. https://endcoal.org/wp-content/uploads/2016/06/BoomAndBust_2016.pdf. (Accessed 6 November 2019).

Telegraaf, 2019. Newspaper Article, Claim Om Kolenverbod Voor Staat, Telegraaf, 5 September 2019. https://www.telegraaf.nl/financieel/1134267479/claim-om-kolenverbod-voor-staat. (Accessed 6 November 2019).

Urgenda I, 2015. C/09/456689/HA ZA 13-1396. Rechtbank Den Haag, 24 June 2015.

Urgenda II, 2018. ECLI:NL:GHDHA:2018:2591. Hof van Den Haag, 9 October 2018.

Van den Bergh, J.C.J.M., Botzen, W.J.W., 2014. A lower bound to the social cost of CO_2 emissions. Nat. Clim. Chang. 4, 253–258. https://doi.org/10.1038/nclimate2135.

Van den Bergh, J.C.J.M., Botzen, W.J.W., 2015. Monetary valuation of the social cost of greenhouse gas emissions. Ecol. Econ. 114, 33–46. https://doi.org/10.1016/j.ecolecon.2015.03.015.